PATENT SPECIFICATION 708,439

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COMPLETE SPECIFICATION.

Improvements in and relating to Stereoscopic Optical Projection.

We, WILLIAMSON MANUFACTURING COMPANY LIMITED, a British Company, of Litchfield Gardens, Willesden Green, London, N.W.10, do hereby declare the invention, (Communicated by KENNETH BELL JACKSON, a British Subject, of the University of Toronto, Toronto, Canada) for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

It is well known to project optically, usually on to a screen, a pair of images which portray the appearances of a thing or things real or imaginary as it or they would appear from two points of view respectively, the points of view being real or imaginary, and usually separate, and to arrange for the images to be viewed by the observer or observers in such a manner that one image is seen by only one eye of each observer and the other image only by the other eye of the said observer. The observer obtains an impression of an image having three dimensions, this three dimensional image being known as a "stereoscopic model" and the pair of images being known as a "stereoscopic pair". Provision is usually made (by adjustment of the projectors) to enable the relative positions, orientations, shapes, and sizes of the images on the screen to be adjusted.

According to the present invention, in conjunction with such a stereoscopic pair, a third smaller image is projected on to the screen in such a way that it is visible to both eyes of the observer and its position on the screen can be adjusted.

For example in the anaglyphic method, the third image may be projected in light made up of colours which will pass with approximately equal strength through the two filters before the observer's eyes; conveniently it may be projected with white light. White light for the third image may also be used in other systems, for example those in which the respective images of the stereoscopic pair are projected in rapidly alternating sequence, shutters being opened and closed before the observer's eyes in a corresponding sequence.

The third image, which for convenience will be referred to as a "floating mark" may be of a spot, mark, scale, grid, or other pattern.

By separate or combined adjustments of the "stereoscopic pair" and the "floating mark" it is possible to make the floating mark appear to occupy any position (i.e. in *three* dimensions) relative to the stereoscopic model.

The floating mark may be made to move in the plane of the screen by altering the orientation of its projector. The stereoscopic model may be made to move in depth, i.e. towards or away from the screen, by a relative lateral movement of the stereo pair across the screen—this is accomplished by moving the projectors, or the slides or lenses in the projectors. As the stereoscopic model is moved in depth by this means, the floating mark appears to move in the opposite depth direction and therefore appears to have complete freedom of movement throughout in relation to the stereoscopic model. The floating mark serves in this manner as a precise pointer both laterally and in depth.

It may be used merely as such, i.e. to identify any point in the stereo model. The adjustments of the stereoscopic pair required to do this also eliminate the necessity for abnormal adjustments of the eyes of the observer. It is therefore possible to show stereoscopic models of great depth to observers inexperienced in stereoscopic examination. This feature of the invention requiring normal vision only, makes it possible to use it as a visual aid in teaching or briefing where any three dimensional conceptions are involved.

It may be used to demonstate the existence and elimination of *y* parallax or want of correspondence in a tilted stereoscopic pair and methods of adjustment of stereoscopic plotting instruments. It may be used to demonstrate the measurement of *x* parallax and the determination of depth in the stereoscopic model.

It may be used to train observers in depth perception, or to select personnel for stereoscopic work.

An example showing how the invention may be given practical effect is diagrammatically illustrated in the accompanying drawings.

Figure 1 is a perspective view of the complete apparatus; and

Figure 2 is a perspective view of the support for the two projectors for projecting the stereoscopic pair of images.

The apparatus comprises two projectors 1, 2 used for projecting the stereoscopic pair of images on to a screen 3, and a third projector 4 for projecting the third image.

The projectors 1, 2 are supported each on a board 5, 6 respectively and they or their mountings on the boards may incorporate usual adjustments (not shown) whereby correct position, orientation and size of the two images relative to one another may be achieved. In any case provision is made in the illustrated example for critical adjustment to be applied to the boards themselves.

To this end each board is supported on a base plate 7 at three points. The first is a universal joint formed by a ball-ended pivot 8 at one front corner of the board resting in a socket 9 on the base 7. This allows the board to rock or swivel in any direction but restrains any translational movement of the pivot ball parallel to the plane of the base 7.

The second is a screw 11 at a rear corner of the board. This engages in a threaded hole in the board and by rotating the screw this corner of the board is raised or lowered in relation to the screw giving the "*y*" adjustment. The bottom of the screw 11 does not rest on the base 7, but is engaged in a block 12 or 13 slidable on a guide strip 14 on the base plate to give the "*x*" adjustment. This is obtained by making the blocks 12, 13 in the form of nuts engaging right and left hand threaded parts respectively of a screw member 15 restrained against axial movement. For example this is achieved by carrying the centre of the member 15 in a bearing block 16 and providing it with a collar 17 on each side of the block. The other ends of the member 15 are journalled in blocks 18 and an adjusting handle 19 is provided at one end of the screw. This form of adjustment causes the two images to move laterally on the screen with equal increments in opposite directions.

To allow freedom for the various relative motions, but no other freedom, the screws 11 has ball ends which are lodged without play in grooves of corresponding form across the tops of the blocks 12, 13.

The third adjustment is a tilt about an axis joining the centres of the ball ends of the pivot 8 and the screw 11. This is effected by a screw 21 conveniently at the opposite front corner of the board to the pivot 8, and the screw 11 is at the rear corner on the same side as the pivot 8; also for convenience in adjustment the supporting arrangements for the two boards are disposed to opposite hands. As the supports at 8, 11 provide lateral constraints, the screws 21 are laterally unconstrained to avoid binding, and simply bear against blocks 22 on the base plate 7, the weight of the projectors maintaining contact.

The screws 11 and 21 are provided with enlarged knurled heads to facilitate adjustment.

As Figure 1 shows, the base plate 7 may be in the form of a table top supported on legs, two of which are visible at 23. The third projector 4 is conveniently supported on a tripod 24 and is provided with a universal adjustment having a handle 25. As shown it projects a small circular spot of light on the screen, and it may comprise a concentrated light source (e.g. a 2 watt concentrated arc lamp) and an achromatic objective (say of 6 inch focal length and 1½ inches diameter) arranged to project a parallel beam. The universal adjustment enables the spot to be moved horizontally and vertically on the screen, while rotation of the handwheel 19 by altering the convergence of the projectors and adjusting the stereoscopic model in depth in relation to the screen, causes an apparent change in the opposite direction of the spot in the depthwise direction of the model.

The example illustrated in the drawings has the screen 3 substantially vertical and the axes of the projector substantially horizontal. It will be understood that the invention is not so restricted. If rearranged with the screen horizontal and the projectors vertical some other form of constraint than the weight of the parts will be necessary but the provisions to be made will be well understood by those skilled in the art of instrument design, and such other controls can also be used with horizontally arranged projectors.

What we claim is:—

1. In a system for the optical projection of a stereoscopic pair of images on to a screen, means for the projection of a third smaller image on to the screen in such a way that it is visible to both eyes of an ob-

server and its position on the screen can be adjusted.

2. A stereoscopic image projection system comprising a pair of optical projectors for throwing a pair of stereoscopically related images on to a screen, the projectors or their mountings being equipped to enable the relative positions, orientations, and sizes of the images on the screen to be adjusted, and a third projector adapted to throw a small image, visible to both eyes of an observer on to any position on the screen.

3. A system according to Claim 2 in which the third image is a simple spot or mark.

4. A system according to Claim 2 or 3 in which each projector is carried on a board universally pivoted at one point to a base, y adjustment being provided for by a screw engaging the board and engaging a sliding block, the two blocks being engaged by right and left handed threads respectively on a screw member restrained from axial movement, whereby x adjustment is given, each board being provided with a further screw adjustment determining its tilt about an axis joining the pivot and the point of engagement of the y adjustment screw with the corresponding block.

5. A stereoscopic image optical projection system, substantially as described with reference to the accompanying drawings.

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PROVISIONAL SPECIFICATION.

Improvements in and relating to Stereoscopic Optical Projection.

We, WILLIAMSON MANUFACTURING COMPANY LIMITED, a British Company, of Litchfield Gardens, Willesden Green, London, N.W.10, do hereby declare this invention (Communicated by KENNETH BELL JACKSON, a British Subject, of the University of Toronto, Toronto, Canada) to be described in the following statement:

It is well known to project, usually on to a screen, a pair of images which portray the appearances of a thing or things real or imaginary as it or they would appear from two points of view respectively, the points of view being real or imaginary, and usually separate, and to arrange for the images to be viewed by the observer or observers in such a manner that one image is seen by only one eye of each observer and the other image only by the other eye of the said observer. The observer obtains an impression of an image having three dimensions, this three dimensional image being known as a "stereoscopic model" and the pair of images being known as a "stereoscopic pair". Provision is usually made (by adjustment of the projectors) to enable the relative positions orientations, shapes, and sizes of the images on the screen to be adjusted.

According to the present invention, in conjunction with such a stereoscopic pair, a third image is projected on to the screen in such a way that it is visible to both eyes of the observer.

For example in the anaglyphic method, the third image may be projected in light made up of colours which will pass with approximately equal strength through the two filters before the observer's eyes; conveniently it may be projected with white light.

This image, which for convenience will be referred to as a "floating mark" may be of a spot, mark, scale, grid or other pattern, and its position on the screen can be adjusted.

By separate or combined adjustments of the "stereoscopic pair" and the "floating mark" it is possible to make the floating mark appear to occupy any position (i.e. in *three* dimensions) relative to the stereoscopic model.

The floating mark may be made to move in the plane of the screen by altering the orientation of its projector. The stereoscopic model may be made to move in depth, i.e. towards or away from the screen, by moving one or both of the stereo pair laterally across the screen—this is accomplished by moving the projectors, or the slides or lenses in the projectors. As the stereoscopic model is moved in depth by this means, the floating mark appears to move in the opposite depth direction and therefore appears to have complete freedom of movement throughout or in relation to the stereoscopic model. The floating mark serves in this manner as a precise pointer both laterally and in depth.

It may be used merely as such, i.e. to identify any point in the stereo model. The adjustments of the stereoscopic pair required to do this also eliminate the necessity for abnormal adjustments of the eyes of the

observer. It is therefore possible to show stereoscopic models of great depth to observers inexperienced in stereoscopic examination. This feature of the invention requiring normal vision only, makes it possible to use it as a visual aid in teaching or briefing where any three dimensional conceptions are involved.

It may be used to demonstate the existence and elimination of y parallax or want of correspondence in a tilted stereoscopic pair and methods of adjustment of stereoscopic plotting instruments. It may be used to demonstrate the measurement of x parallax and the determination of depth in the stereoscopic model.

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708,439 COMPLETE SPECIFICATION
1 SHEET
This drawing is a reproduction of the Original on a reduced scale.

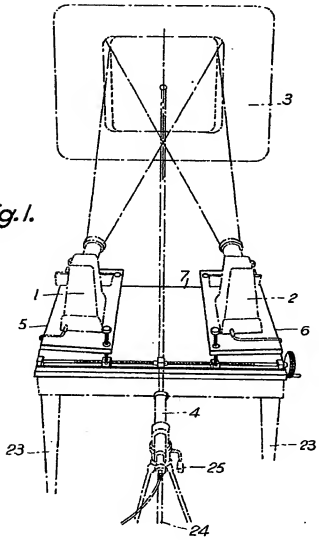

Fig. 1.

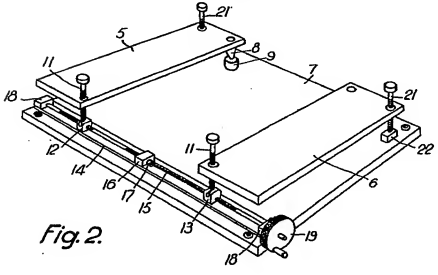

Fig. 2.